**Teaching the Concept of Digestive Function and Structure**

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Curriculum Expectations:

*Overall:*

D3 – Demonstrate an understanding of chemical components of and energy in food, and the processes by which food is digested

*Specific:*

D3.1 – describe the basic chemical components of proteins, carbohydrates, fats, and lipids, and vitamins and minerals, and explain their functions in the body

**D3.4 – describe the structure and function of the components of the digestive system with respect to physical and chemical digestion**

Background Info:

All cells within the body require energy in order to survive. In order to obtain this energy, the body must break down larger molecules called macromolecules, into smaller, more manageable pieces of energy called ATP (adenosine triphosphate). These larger molecules come from the food we eat, which enters the body through the digestive system.

As with any system in the body, the digestive system is made up of many different organs that work together. The purpose of the digestive system is to break down the food that we eat, and convert it into an energy form that the body can use efficiently.

The foods that we eat all contain different nutritional values, and each type of food has a different niche in the body. The three main food types are carbohydrates, fats and lips, and proteins. Foods also contain vitamins and minerals that are essential to different bodily processes, and must be derived from the food we eat.

The organs that are contained within the digestive system are the mouth, esophagus, stomach, small intestine, large intestine, rectum, anus, liver, pancreas, gall bladder, appendix, and the salivary glands. All of these organs are connected along one tube that stretches from the mouth to the anus, allowing food to pass through the body, have the essential parts used, and the waste to be evacuated.

The digestive system falls in the middle of the body, and connects to every other major system in the body. Since the energy for the body must come from the food we eat, all other systems must be connected to the digestive system in some way. The most interconnected system to the digestive tract is the circulatory system, which carries blood next to the small intestine in order to collect the nutrients as they are digested to other parts of the body, as well as expel wastes from the body.

Lesson Sequence:

Lesson #1: Introduction to the Digestive System

In this lesson, students will be introduced to the concept of the digestion system.

Lesson #2: Organ Overview

In this lesson, students will go into more depth about the different organs of the digestive system.

Lesson #3: Fluids in the Digestive System & Physical and Chemical Digestion

In this lesson, students will learn about the different fluids in the digestive system including: bile, saliva, mucus, and acid.

Lesson #4: Accessory Organs

In this lesson, students will learn about the accessory organs to the digestive system: the salivary glands, the liver, the gallbladder, and the pancreas.

Lesson #5: Other Systems that Connect

In this lesson, students will learn about the other organ systems that have the biggest connections with the digestive system.

Lesson #6: Presentation of Digestive Sequence

In this lesson, students will present their organ with respect to the digestive system. They will cover the sections as mentioned before (name, function, what is digested there, fluid, mechanical vs. chemical digestion, time spent in organ, and problems associated with the organ). They can present using a variety of methods including: song/rap, PowerPoint, manipulatives, etc. It is the students’ choice, but it must involve the audience in some way and be extremely interactive.

Advance Preparation/Teaching Ideas:

Lesson #1: Introduction to the Digestive System

In this lesson, students will be introduced to the concept of the digestion system.

The activity will start out with students brainstorming in small groups (3-4 people) everything they already know about the digestive system. Its functions, its organs, where it is in the body, etc. Then the teacher will put up an outline of the human body on the board/document camera, and student groups with come up and list off organs, purposes, and the food path. In the end, the picture will look like a labeled diagram of the digestive system.

Students will write down the parts of the system and the other facts presented by groups on their own, smaller version, of the outline of the system. Students will then highlight/circle the parts that they didn’t know, and in a different colour, the things they want to learn more about. This will be assessment AS learning, as students will be self-assessing to see how much they already know about the digestive system.

Lesson #2: Organ Overview

In this lesson, students will go into more depth about the different organs of the digestive system.

The activity will start with the teacher having a long hose (in proportion to the correct length of the digestive track) with sections labeled, or attached “bubbles” where the stomach and mouth are (ideas for this are boat buoys cut like a doughnut, or wrapped bubble wrap to show the diameter difference). The teacher will go through the path that food would take.

Students will come up with their own analogy for the digestive system (race track, school, etc.) and label all the parts correctly. Students will then exchange analogies with another student, and mark them together, looking for consistency and continuity (assessment FOR learning). From this information, students will also pick an organ that they would like to study and present. Choices are: mouth, esophagus, stomach, duodenum, small intestine, large intestine, and colon. They will be required to present: name, function, what is digested there, fluids, mechanical vs. chemical digestion, time spent in organ, and problems/disease associated with organs.

Lesson #3: Fluids in the Digestive System & Physical and Chemical Digestion

In this lesson, students will learn about the different fluids in the digestive system including: bile, saliva, mucus, and acid.

In this activity, the teacher will demonstrate the difference between physical and chemical digestion with two hands-on activities. In one, students will watch as the teacher breaks up graham crackers in a Ziploc bag using a hammer. This will demonstrate to students that physical digestion involves breaking the pieces into smaller bits using force. This happens in the mouth, and in other places in the digestive system. The other demonstration will be using enzymes to break down Jell-O. The enzymes in pineapple juice break down the collagen in the Jell-O, and stop it from congealing.

Students will observe and take part in the experiments, taking notes. Then they will complete a table as to where and how the 3 different food types are broken down and digested in the body (See Appendix B). Teacher will assess this based on accuracy.

Lesson #4: Accessory Organs

In this lesson, students will learn about the accessory organs to the digestive system: the salivary glands, the liver, the gallbladder, and the pancreas.

The activity will focus on learning stations. Each corner of the classroom will have resources all about the accessory organ. These can be videos, textbooks, journal articles, manipulates, magazines, newspapers, etc. Students use these media items to compile information about the accessory organs, as per a hand out (See appendix A).

Students will complete the chart based on the information at the stations. They will be encouraged to talk with their travelling group about the different organs and the information they require. Students will need to rewrite information in their own words. Teacher will assess their chart based on accuracy, and also be looking for classroom participation from students.

Lesson #5: Other Systems that Connect

In this lesson, students will learn about the other organ systems that have the biggest connections with the digestive system.

The activity will focus on the interconnectedness of the human body’s organ systems. Since this is one of the final lessons in the series, students should have some background about different organ systems, and have seen in literature and research that they interconnect with the digestive system. Students will stand in a circle around the teacher who will represent the digestive system and who is also holding a ball of string. Students will all get a slip of paper that has a major organ system that interconnects with the digestive system (respiratory, circulatory, lymphatic, urinary). When the teacher throws the ball to a student, they have to respond with one way that their system (on their slip of paper) interacts with the digestive system (i.e. the circulatory system controls the blood vessels in the esophagus, which control the peristaltic waves). Then they throw the ball back to the digestive system. When everyone is holding their piece of string, the teacher will bring to the students’ attention how interconnected the digestive system is, and how it could never be completely separated.

The students will then complete a mind map, with the digestive system in the middle. They will pick 2 major organ systems from the activity, and one system that was not (i.e. skeletal, muscular, nervous, etc.). Then they must interconnect the 3 in as many ways as possible, making sure to link back to the digestive system as often as possible. Teacher will assess based on number of links, accuracy, and presentation.

Lesson #6: Presentation of Digestive Sequence

In this lesson, students will present their organ with respect to the digestive system. They will cover the sections as mentioned before (name, function, what is digested there, fluid, mechanical vs. chemical digestion, time spent in organ, and problems associated with the organ). They can present using a variety of methods including: song/rap, PowerPoint, manipulatives, etc. It is the students’ choice, but it must involve the audience in some way and be extremely interactive.

Students will pass a tennis ball when they finish their presentation to the next organ in the line – this ball will represent the food that is passing through the digestive track. They can use the ball in their presentation to demonstrate mechanical digestion if they like.

Audience will have to take notes down about the different organs so that they connect with the subject matter. They will also complete a peer assessment as to how much information they feel was put across, how engaging it was, and what they could improve on. This will go into the presenter’s mark, as well as an audience participation mark for the students. (Assessment FOR learning)

The test will be a more detailed version of the labeling activity done at the beginning of the concept – they will have to label the organs, as well as their functions, what is digested there, and one problem associated with that organ. (Assessment OF learning)

Potential Student Difficulties and Solutions:

*Idea of where blood flows within the body* – some students might not realize how much of the circulatory system is concentrated onto the digestive system. Teacher can have students draw a diagram or write in words how and where blood flows within the body, and the teacher can build the lesson on blood on onto that. Solutions could be analogies to this; such as the small intestine being like a mine, and the buckets that collect the coal is the blood stream.

*Concept of food being “inside” the body* – since the digestive system is a connected tube that stretches from the mouth to the anus; it acts like the hole in the centre of the doughnut. The food is never considered “inside” the body, until the nutrients are broken down and absorbed by the blood stream. Teacher can explain this using the doughnut example, and continue to stress that having food in your digestive system is like holding a stick in your hand – your body is around it, but it is not “in” your body.

*Understanding the interconnectedness of the organ systems* – All organ systems within the body are interconnected, however students might not understand that, and think they can all stand on their own. Doing the ball and strong activity will help students to see how other systems play a role in the digestive system.

Applications and Societal Issues/Implications:

This lesson sequence focuses on the organs and process of digestion. Later lessons will connect to what foods people need to eat to stay healthy, and what happens when people veer away from healthy eating habits. This will connect to drastic crash diets, fad diets, and eating disorders. These ideas will focus on both men and women. Another main focus of these lessons will be people who have to remove some type of food from their diet for health reasons, like allergies and sensitivities.

It will also connect to chemical additives in food that have no nutritional value. Why are they there, and what are they doing to our bodies? This will forum into a debate as to whether or not foods should have these non-nutritive food additives: they help food last longer, which can assist people living in lower income homes, but they might do damage to our bodies in the long term, that we are unaware of that this time.

Accommodations for Special Education and English Language Learners:

This unit will use a lot of hands-on analogies and activities that will help students learn in a variety of ways. The end task of having each group present on their organ gives students the flexibility to present their topic in an engaging and multiple intelligence format that can assist students with special education requirements. For ELLs, there will a lot of pictures in every lesson. Students know that everyone has a digestive system; so breaking it down into a very visual experience will assist students with a language barrier.

Since this is such a universal topic, there will be lots of resources that are available in different languages for research and discussion lessons.

Annotated References:

Brady, M., Whyte, J., & McDonald, W. (N.Y.). *Young Voices; Life with Diabetes. Lesson 2: Digestions of Fats, Proteins, And Carbohydrates.*  Discovery Health. Retrieved on November 17th, 2011. From: <http://www.discoveryeducation.com/diabetes/pdf/Lesson2.pdf>

N.A. (2008). *Your Digestive System and How it Works.* NIH publications, Bethesda, MD. Retrieved on November 16th, 2011. From: <http://digestive.niddk.nih.gov/ddiseases/pubs/yrdd/index.aspx> - Used for background information

National Geographic. (2009). *Digestive system photos.*  Retrieved on November 16th, 2011. From: <http://science.nationalgeographic.com/science/photos/digestive-system-gallery/digestive-system.html> - Used for pictures in PowerPoint

Appendix A: Accessory Organ sheet

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| --- | --- |
| *Pancreas*  Place in the digestive system:  Fluid secreted?  What is it?  Main function:  Use in physical/chemical digestion: | Liver  Place in the digestive system:  Fluid secreted?  What is it?  Main function:  Use in physical/chemical digestion: |
| Salivary Glands  Place in the digestive system:  Fluid secreted?  What is it?  Main function:  Use in physical/chemical digestion: | Gallbladder  Place in the digestive system:  Fluid secreted?  What is it?  Main function:  Use in physical/chemical digestion: |

Appendix B: Physical vs. Chemical Digestion Chart

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| --- | --- | --- | --- | --- | --- |
|  | Mouth | Stomach | Duodenum | Small Intestine | Large Intestine |
| Carbohydrates |  |  |  |  |  |
| Fats & Lipids |  |  |  |  |  |
| Protein |  |  |  |  |  |